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Utilization of Rock Materials In Lower Chesapeake Bay Bridge-Tunnel

By Richard F. Pharr

Contracts totaling $10 million for rock materials to be used in building the $200 million lower Chesapeake Bay Bridge-Tunnel set in motion a large undertaking for Virginia crushed rock producers. The bridge and tunnel structures that will connect the southern tip of the Eastern Shore peninsula with Chesapeake Beach, near Norfolk, by the fall of 1963 will require 1,699,180 tons of igneous rock and 500,000 tons of sand and gravel, in addition to materials for 185,000 cubic yards of ready-mix concrete.

The job of supplying these materials was awarded in contract in December 1960, to the Southern Materials Company, Inc., of Norfolk. Southern Materials Company in turn negotiated contracts with three other producers in Virginia: W. E. Graham and Sons Division, Vulcan Materials Company, Boydton; Trego Stone Corporation, Skippers; and Tidewater Crushed Stone Company, Richmond. The Greystone Quarry Division of Vulcan Materials Company, Henderson, North Carolina, is supplying part of the rock tonnage contracted by Vulcan Materials Company. A contract was also given to the Superior Stone Company, Roesville, North Carolina. Each of the above five companies is to furnish one-fifth of the total required rock material. All sand and gravel for concrete aggregate is being furnished by Southern Materials Company (Figure 1).

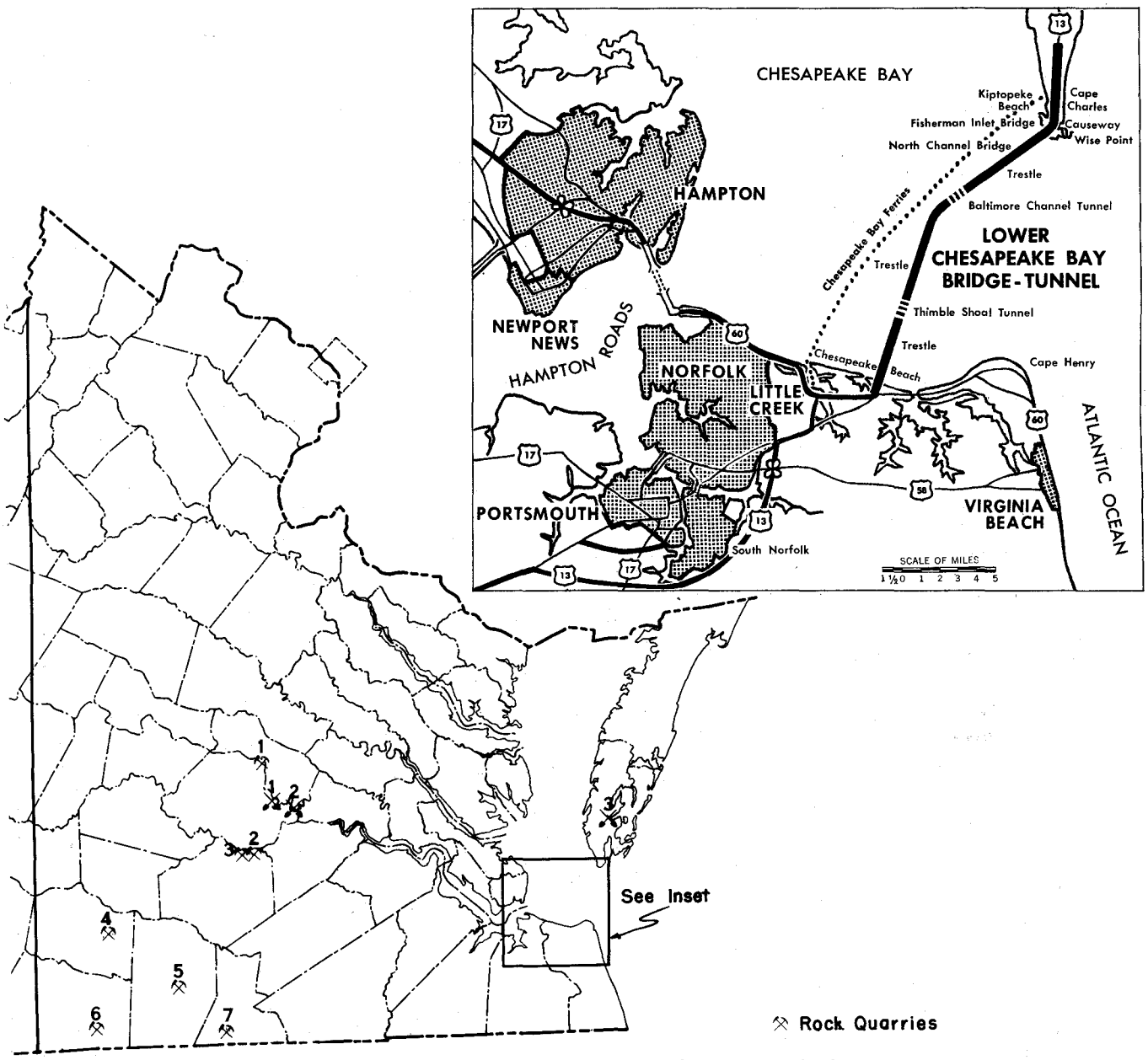
Bridge-Tunnel Complex

The total length of the bridge-tunnel complex, including approach roads, is approximately 22½ miles. Of this distance, almost 18 miles are over open water (Figure 1, inset).

The complex consists of seven major component structures:

		Approximately
1.	Low Level Trestle	11¾ miles
2.	Thimble Shoal Tunnel and Islands	1¾ miles
3.	Baltimore Channel Tunnel and Islands	1½ miles
4.	North Channel Bridge & Approaches	¾ mile
5.	Fisherman Inlet Bridge & Approaches	¼ mile
6.	Fisherman Island Causeway	1¾ miles
	Total Length of Project over water	17¾ miles
7.	Approach Roads (Approximately)	5 miles
	Approximate Length of Project	22½ miles

The major portion of the project will consist of low level trestles over relatively shallow water. (Water depth ranges from approximately 20 to 30 feet). The trestle structure will consist of 825 precast, prestressed concrete spans of 75 feet each, and precast concrete bent-caps supported on hollow, precast, prestressed cylindrical concrete piles that are 54 inches in diameter. (Prestressing is a method of applying tension to concrete to increase its structural strength). The ends of the spans will be supported by a tier of three piles, driven deep into the bed of the Bay (Figures 2 and 3). The piles will be filled with sand to enable them to withstand any shock of a collision by small boats or ice floes. The roadway surface will have a width of 28 feet, with an 18 inch safety walk on each side, and will be placed at level grade 30 feet above high water level for protection against wave action.



⚒ Sand and Gravel Operations

1. Southern Materials Company, Inc. Chesterfield County, (Kingsland Reach Plant)
2. Southern Materials Company, Inc. Henrico County, (Curles Neck Plant)
3. Southern Materials Company, Inc. Northampton County, (Seaview Plant)

⚒ Rock Quarries

1. Tidewater Crushed Stone Company Chesterfield County
2. Southern Materials Company, Inc. Dinwiddie County, (Jack Quarry)
3. Southern Materials Company, Inc. Dinwiddie County, (Rip-Rap Quarry)
4. Tidewater Crushed Stone Company Lunenburg County, (Rip-Rap Quarry)
5. Southern Materials Company, Inc. Brunswick County, (Rawlings Quarry)
6. W. E. Graham and Sons Division, Vulcan Materials Company Mecklenburg County, (Buggs Island Quarry)
7. Trego Stone Corporation, Greensville County

Figure 1 — Location map of sand and gravel operations and quarries producing material for the Chesapeake Bay Bridge-Tunnel project

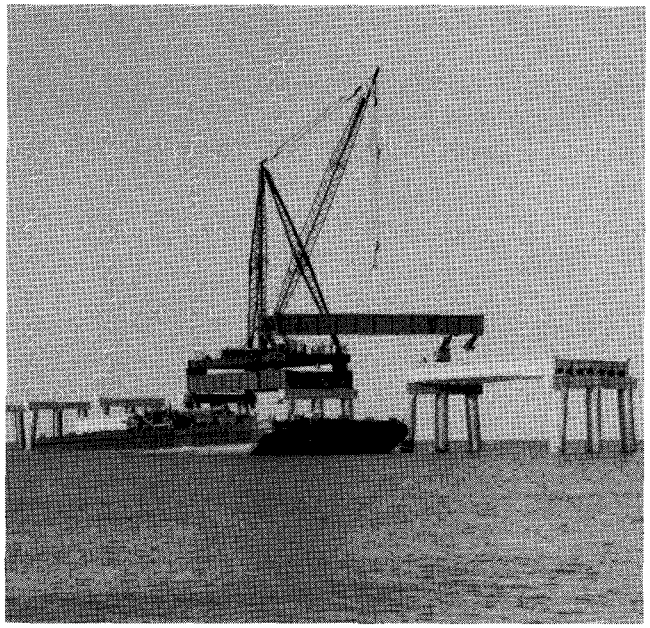


Figure 2 — Slab-setter used to mount deck units

Tunnels will provide the link under the two major ship channels entering Chesapeake Bay: The Thimble Shoal Channel, by which ships from the Atlantic Ocean enter the deep waters of Hampton Roads, and the Baltimore Channel, which furnishes entrance to the Upper Chesapeake Bay and the ports of Baltimore, Annapolis, and Alexandria. The tunnel sections, manufactured by the American Bridge Division of United States Steel Corporation at Orange, Texas, consist of watertight sections of double-walled steel casing, 37 feet in diameter and 300 feet in length, that have webbing of reinforcing steel (Figures 4 and 5). The tubes are completely fabricated and assembled at Orange, Texas, and are towed 1700 miles to Norfolk. At a "shape-up" basin in Norfolk, a large portion of the remaining outfitting is completed (Figure 6). When ready for location, the sections are floated to the tunnel site, sunk into a prepared trench, and locked by divers to the preceding section. After the sections are secured in position they are covered with selected backfill material and crushed stone that are then protected by a final cover of heavy rip-rap to prevent undermining (Figure 7). The construction details for each tunnel are identical except for variations in length and grade. The Thimble Shoal tunnel will have a portal-to-portal length of 6,200 feet and the Baltimore Channel Tunnel a portal-to-portal length of 5,664 feet. Each will have a roadway width of 24 feet and an overhead clearance above the roadway surface of 14 feet. At its lowest point the roadway surface will be 98 feet below mean low water.

Four artificial islands will support the depressed approach ramps to the tunnel and provide an area for the tunnel ventilation buildings and housing for emergency equipment. Each of these islands will measure approximately 1,600 feet in length and 230 feet in width and will be about 30 feet above mean low water. The main core of the islands is composed of sand dredged from the bottom of the bay. To prevent washing out and undermining of this sand core, a solid row of prestressed concrete sheet pilings will be driven around its periphery. In addition, quarry-run stone, protected by heavy rip-rap stone and precast concrete shore protection units, will be used as added protection outside the sheet piling (Figures 8, 9, and 10).

Two fixed high-level bridge structures near the northern end of the complex will provide accommodations for local fishing vessels. The

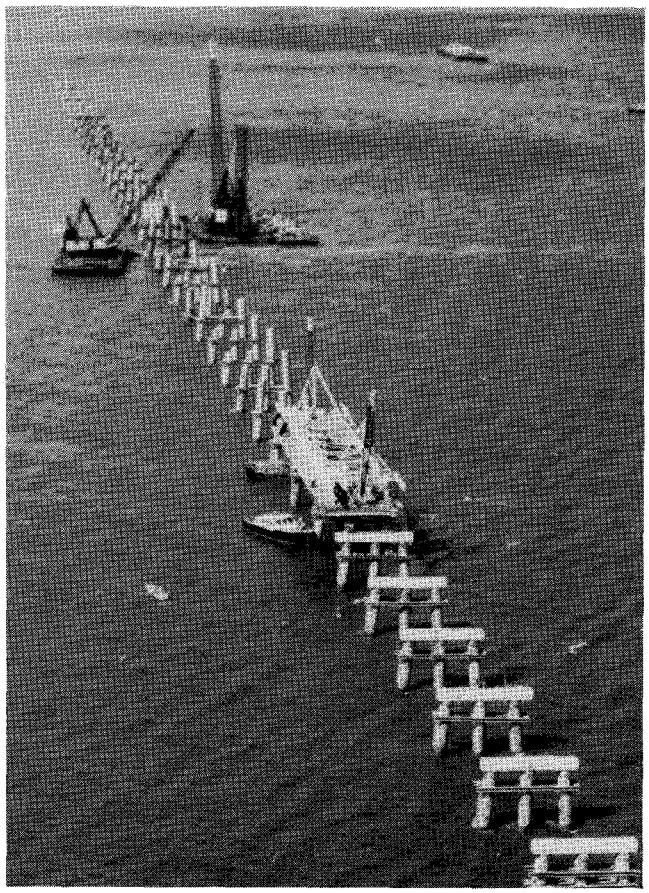


Figure 3 — Concrete piles, some of which have been capped by "bents"

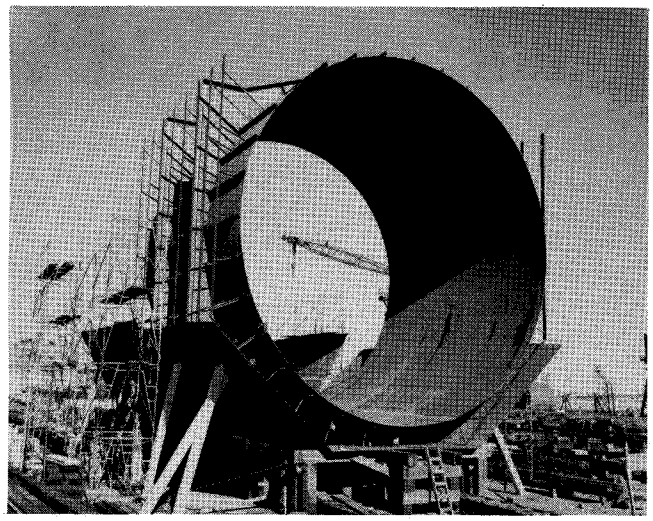


Figure 4 — Fabrication of a tunnel section at the American Bridge Division of United States Steel Corporation, Orange, Texas

North Channel Bridge, located just southwest of Fisherman Island, will provide a navigational opening of 300 feet horizontal clearance and 75 feet vertical clearance above mean high water. The Fisherman Inlet Bridge, which is over one of the dredged channels of the inland waterway, will provide a navigational opening of 110 feet horizontal clearance and 40 feet vertical clearance above mean high water. Each bridge will have a roadway width of 28 feet, with 18-inch emergency sidewalks on the sides. The superstructure spans of the bridges will be supported on reinforced concrete piers founded on steel H piles.

The causeway across Fisherman Island will provide a road surface 24 feet wide with a 10 foot shoulder on each side. The roadway surface will be constructed on an earthfill embankment with a surface 15 feet above mean low water. Where necessary, the sideslopes of the embankment will be protected by rip-rap from wave action and erosion.

Rock Materials

Sand and Gravel

A large part of the more than ½ million tons of sand and gravel being produced for the project by Southern Materials Company will be used at the Cape Charles plant of the Bayshore Concrete Products Corporation in the manufacture of concrete components for the bridge (Figure 11). Three major groups of trestle components, cylinder piles, bent caps, and deck units are mass-produced at the Bayshore Plant. Sand and gravel for this purpose is being mined by Southern Materials Company from deposits at Curles Neck, Henrico County; Kingsland Reach, Chesterfield County; and from near Seaview, Northhampton County (Figure 12).

For use in the manufacture of bent caps and prestressed pilings, coarse gravel produced from deposits at Curles Neck is blended at the Bayshore Plant with fine sand produced from deposits near Seaview. The ratio of the blend is roughly two parts coarse aggregate to one part fine aggregate.

In the manufacture of prestressed deck units, gravel-size material produced from deposits at Kingsland Reach is blended with fine sand produced near Seaview.

Specifications for sand gravel being used in each of the concrete components are given below.

Gravel for deck units. This is also the coarse aggregate used in superstructures.

Sieve Size	Percent Passing
1″	100
¾″	92-100
½″	25-65
#4	0-5
#10	0-2

Gravel aggregate for pilings and bent caps.

Sieve Size	Percent Passing
1½″	100
1″	95-100
½″	25-60
#4	0-10

Sand for all units

Sieve Size	Percent Passing
⅜″	100
#4	95-100
#8	80-95
#16	65-85
#30	30-50
#50	8-25
#100	0-10
#200	0-5

In addition to the amount used in concrete, an estimated 3.6 million cubic yards of sand will be used to form the cores of the four artificial islands and another estimated 2 million cubic yards will be used in the laying and covering of the tunnel

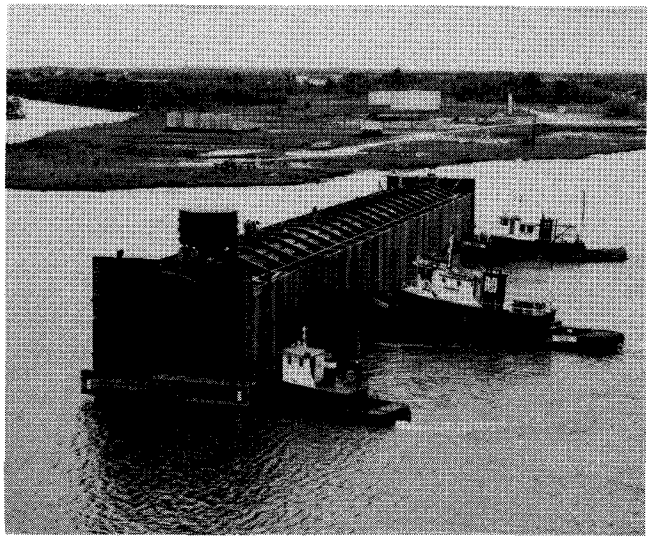


Figure 5 — Tunnel section being pushed out to sea by tugs to begin 1700 mile sea journey from Orange, Texas to Norfolk

sections. The majority of the fill to be used in forming the cores of the islands will be pumped or dredged from the bottom of the bay by construction companies and is designated as "hydraulic fill". Sand and gravel designated as "foundation fill", "barge fill", and "hydraulic fill", will be used in that order, as needed, in various stages of building the tunnel sections (Figure 7).

As soon as the bottom of the trench for each tunnel section is properly graded, it is lined with foundation fill placed by clamshell bucket or other methods. The surface is then dragged to provide a smooth and even foundation bed for the tunnel sections. After the tunnel sections are sunk into final position on the foundation bed and proper grade and alignment has been made, hydraulic and barge fill will be placed in uniform layers of equal height on each side of the sections (Figure 7).

The specifications for the foundation fill require sand or gravel or a mixture of sand and gravel, 100 percent passing a ½-inch sieve, not more than 10 percent by weight passing a No. 100 sieve, and not more than 5 percent by weight passing a No. 200 sieve.

The specifications for the barge fill and hydraulic fill require sand or gravel or a mixture of sand and gravel, at least 90 percent by weight passing a ½ inch sieve and not more than 6 percent by weight passing a No. 200 sieve.

STONE

Most of the rock needed in the bridge-tunnel project will be used in connection with the building of the artificial islands and the construction of protective covers for the tunnel units. As previously mentioned each of the five producers under contract is to furnish one-fifth (366,200 tons) of the total tonnage. Although this is a large order of stone for an individual producer, it is not out of the ordinary for any of the five large producers involved. The factor that makes the order difficult, however, is the wide range in the specifications of the required stone. Shipments from all quarries include materials which range from ¾ inch in size to pieces weighing 2,000 pounds. Rip-rap blocks, many of which weigh 15 tons and are approximately 6 x 6 x 5 feet in size are being supplied by all quarries except the Brunswick County quarry of Southern Materials Company.

Since specifications for crushed rock needed in building the bridge and tunnel structure differ from those for materials normally produced by these companies, modifications in plant facilities and quarrying techniques were necessary. W. E. Graham and Sons installed a new 250 foot conveyer system at their quarry near Boydton. The company also extended a rail siding 200 feet and constructed a new loading bin. Tidewater Crushed Stone Company installed a scalping

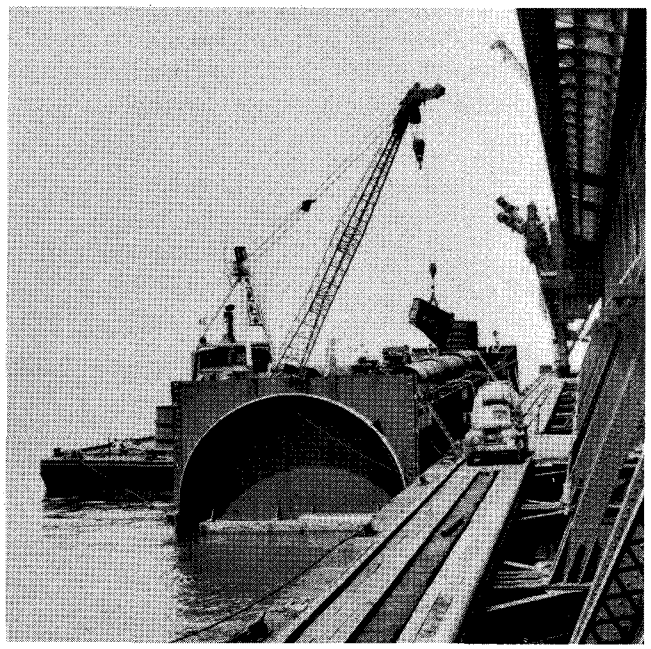


Figure 6 — Tunnel section moored at shape-up basin in Norfolk

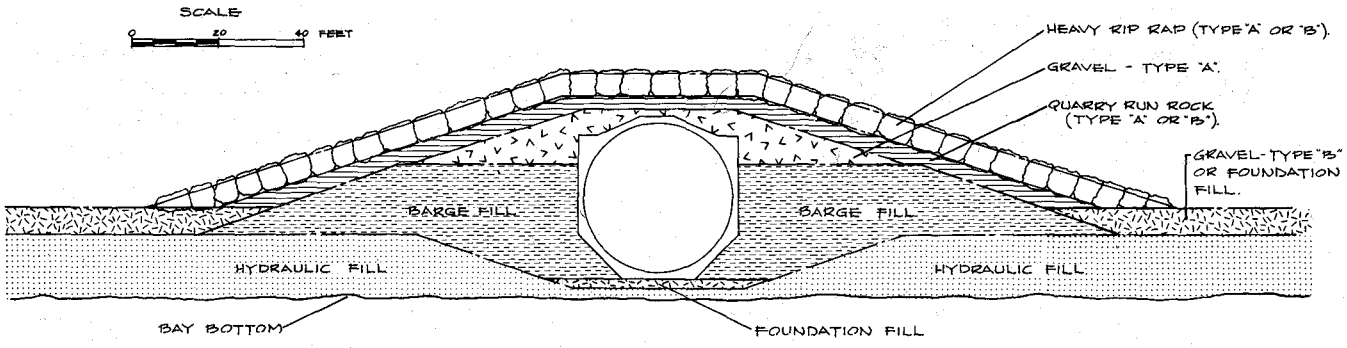


Figure 7 — Cross section of tunnel near an island approach

screen following their primary crusher at their quarry in Richmond and purchased cranes and diesel shovels. Trego Stone Corporation purchased a diesel shovel and two additional trucks for use at their quarry near Skippers. Southern Materials Company installed conveyor belts at their Dinwiddie County quarry and a vibrating scalping plant at their Brunswick County quarry.

A major problem confronting the producers is that of obtaining and moving the large blocks of rip-rap. Two producers found it advantageous to open quarries exclusively for the production of rip-rap. Southern Materials Company established quarry operations just east of their Dinwiddie County plant near Petersburg and Tidewater Crushed Stone Company began operations at a quarry near Kenbridge, Lunenburg County. Various methods of blasting are used in quarrying these large blocks. The method used by the quarry operator is generally based on the characteristics of the rock at the quarry. Where joint and fracture systems are well developed, widely spaced holes and low charges are used to drop the large blocks intact. W. E. Graham and Sons experimented with a method of "lifting" the rock with black powder. Although modern explosives replaced black powder a good many years ago the method worked well and was later employed by other companies.

Several methods are used to load the rip-rap blocks onto trucks and from the trucks onto rail cars. Southern Materials Company and Tidewater Crushed Stone Company are using cranes equipped with grapple hooks (Figure 13). The former company designed a unique truck bed to haul and unload the large blocks. The specially

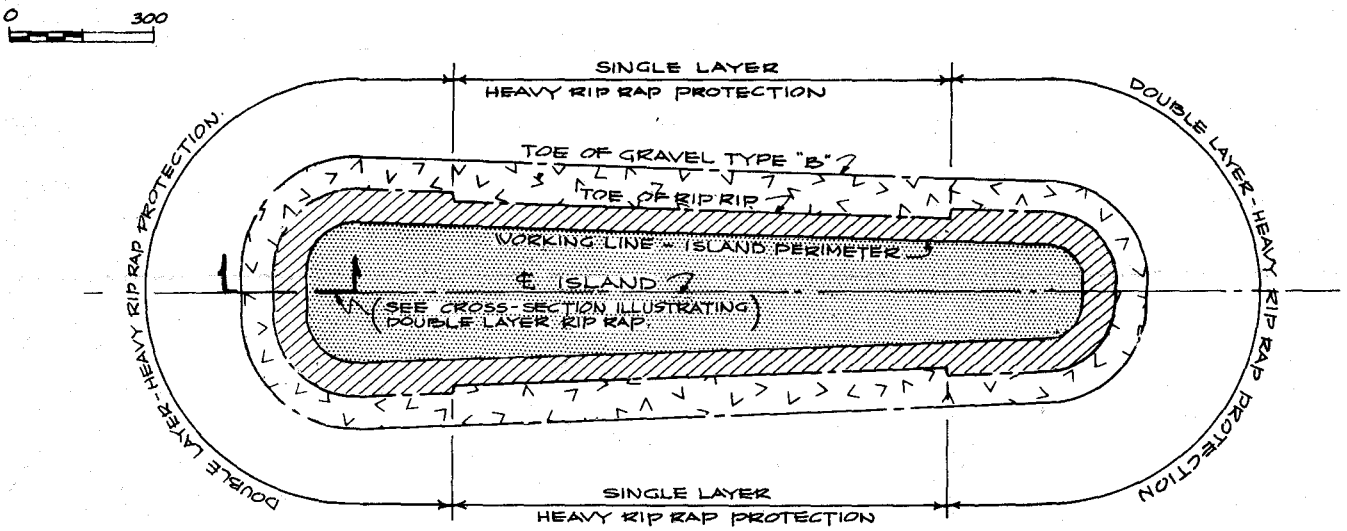


Figure 8 — Generalized plan view of Thimble Shoal and Baltimore Islands illustrating layers of rock protection

Figure 9 — One of four artificial islands beginning to appear at surface

designed bed, lower and longer than the standard truck bed, allows the block to slide almost to the ground thus lessening the chance of breaking. This is important since the breaking of a large block generally brings its weight below that required and prevents its use for rip-rap. W. E. Graham and Sons are handling the blocks by the use of an expansion wedge and pin which is placed into a hole drilled into the top of the block (Figure 14). Trego Stone Corporation is employing the use of chains looped about the blocks. The chain is left on the block after it is placed on a truck in the quarry and taken off after the block is loaded by crane onto a rail car.

All shipments of rock are made by rail, in gondola type cars, to Sewells Point, Norfolk (Figures 15 and 16). In order to eliminate stockpiling of the rock at the Norfolk terminal shipments are made only on orders of the project engineers. At Sewells Point, the rock is loaded on barges for delivery to the job site (Figure 17). The following table gives for each Virginia producer, the type of rock being quarried, the locations of the quarries, and the railroads handling the shipments.

The contract for igneous rock to be furnished for the project calls for the following types and quantities:

Type A Gravel Fill. (287,550 tons). Type A gravel fill shall be composed of angular particles having a uniform gradation in size from ¾ of an inch to 6 inches, subject to the following modifications:

a. Random material coarser than 6-inch size, but not exceeding 400 pounds per unit, shall be included.

b. The amount of coarse material exceeding 100 pounds per unit shall not be more than 20 percent of the total by weight.

Subject to the above requirements, by-products and waste or residue of quarrying operations may be used as the materials for Type A gravel fill.

Type B Gravel Fill. (337,500 tons). Type B gravel fill shall be composed of angular particles having a uniform gradation in size from ¾ of

Producer	Location of Quarry and Rock Type	Railroad Handling Shipments
W. E. Graham and Sons Div. Vulcan Materials Co.	6 miles southeast of Boydton, Mecklenburg Co. (Red Oak granite)	Atlantic and Danville Ry. to Suffolk, Norfolk and Western Ry. to Sewells Point
Southern Materials Co., Inc.	5 miles west of Petersburg, Dinwiddie Co. (Petersburg granite)	Norfolk and Western Ry. to Sewells Point
	5¼ miles west of Petersburg, Dinwiddie Co. (Petersburg granite)	Norfolk and Western Ry. to Sewells Point
	Rawlings, Brunswick Co. (Petersburg granite)	Seaboard Air Line R. R. to Petersburg, Norfolk and Western Ry. to Sewells Point.
Tidewater Crushed Stone Co.	Richmond (Petersburg granite)	Seaboard Air Line R. R. to Petersburg, Norfolk and Western Ry. to Sewells Point.
	2 miles south of Kenbridge, Lunenburg Co. (Red Oak granite)	Norfolk and Western Ry. to Sewells Point.
Trego Stone Corp.	1 mile southwest of Skippers, Greenville Co. (Petersburg granite)	Atlantic Coast Line R. R. to Jarrett, Norfolk and Western Ry. to Sewells Point.

an inch to 6 inches, subject to the following modifications:

a. Random material coarser than 6-inch size, but not exceeding 2,000 pounds per unit, shall be included.

b. The amount of random material coarser than 6-inch size shall not be more than 30 percent by weight, nor less than 10 percent by weight.

Subject to the above requirements, by-products and waste or residue of quarrying operations may be used as the materials for Type B gravel fill.

Type A Quarry Run Rock. (362,050 tons). Type A quarry run rock shall be composed of angular stones weighing not less than 125 pounds each and not more than 1,000 pounds each, averaging 500 pounds each, except that approximately 10 percent by weight may consist of pieces weighing from 10 to 125 pounds each. Neither the width nor thickness of any piece of Type A quarry run rock shall be less than one-third its length.

Stones for Type A quarry run rock shall be sound, durable, igneous or metamorphic rock, obtained from approved sources and shall be free from seams, cracks, and other imperfections tending to destroy its resistance to weathering and the action of sea water. The stones shall be free from rounded, worn, or weathered surfaces and shall have a unit weight of at least 166 pounds per cubic foot.

Type B Quarry Run Rock. (183,960 tons). Type B quarry run rock shall be composed of angular stones weighing not less than 500 pounds each and not more than 2,000 pounds each, averaging 1,000 pounds each, except that approximately 10 percent by weight may consist of pieces weighing from 100 to 500 pounds each. Neither the width nor thickness of any piece of Type B quarry run rock shall be less than one-third its length.

Stones for Type B quarry run rock shall be sound, durable, igneous or metamorphic rock, obtained from approved sources and shall be free from seams, cracks, and other imperfections tending to destroy its resistance to weathering and the action of sea water. The stones shall be free from rounded, worn, or weathered surfaces and shall have a unit weight of at least 166 pounds per cubic foot.

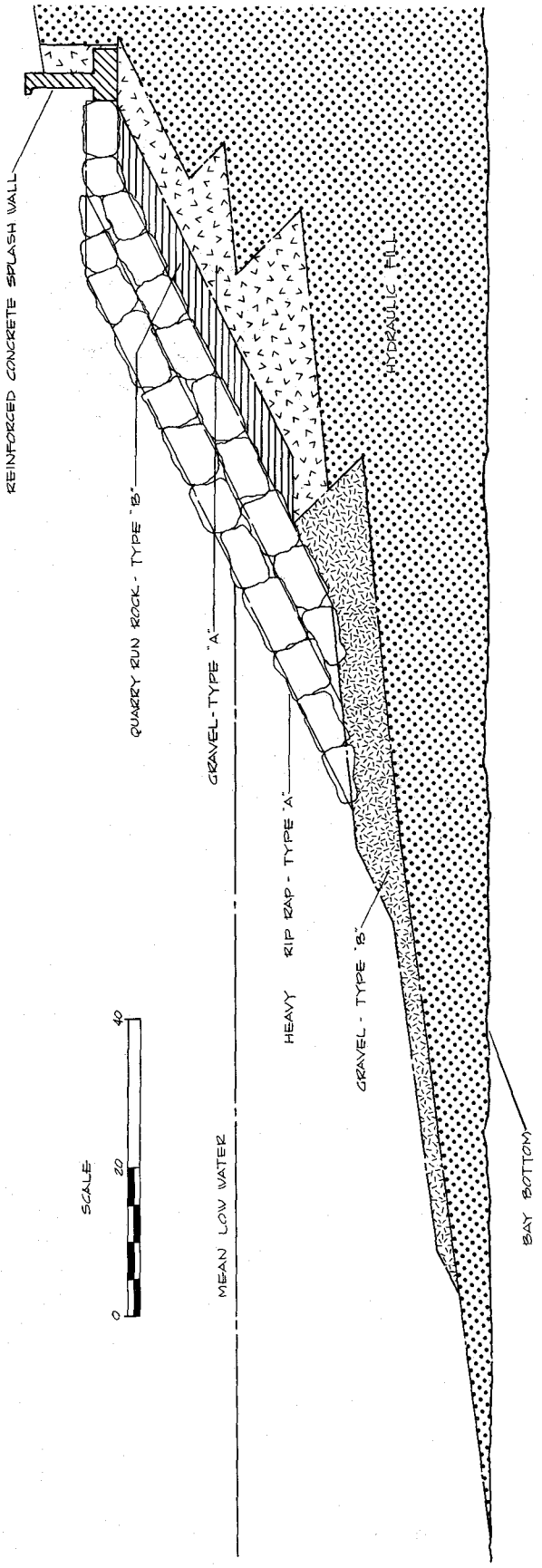


Figure 10 — Cross section through double layer rip-rap protection cover of island

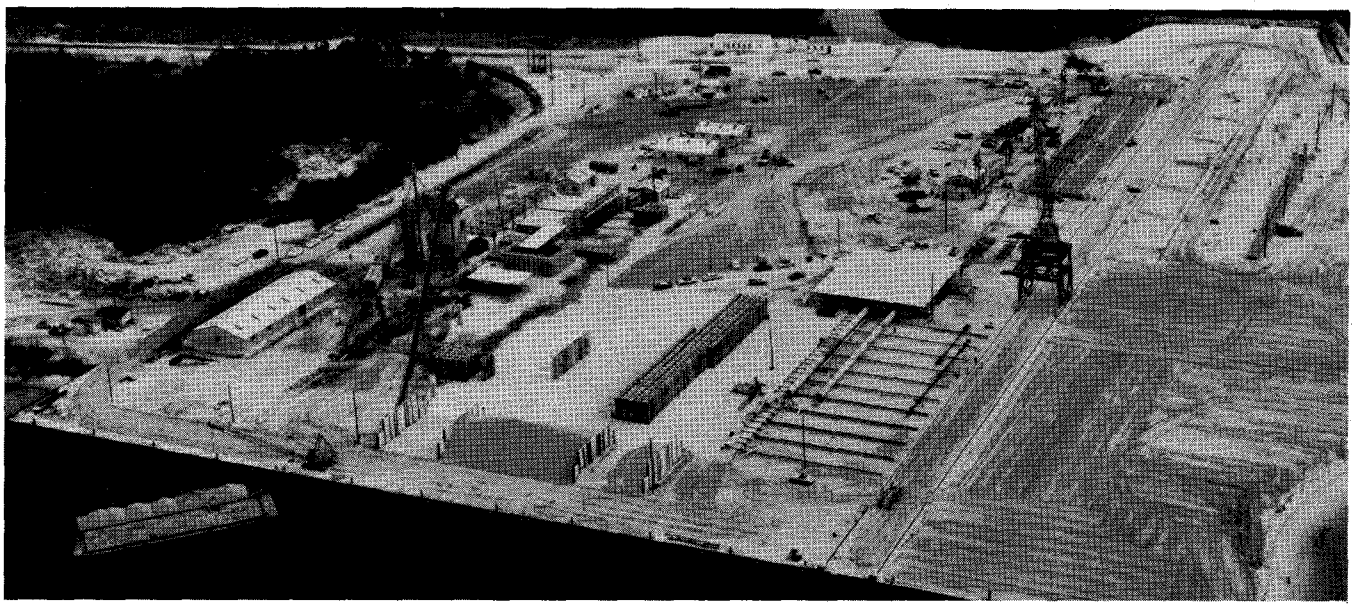


Figure 11 — Cape Charles Plant of the Bayshore Concrete Products Corporation

Type A Heavy Rip-Rap. (447,120 tons). Type A heavy rip-rap shall be composed of angular stones weighing not less than 10 tons each, except that approximately 10 percent by weight may consist of pieces weighing from 6 tons to 10 tons each. Neither the width nor thickness of any piece of Type A heavy rip-rap shall be less than one-third its length.

Stones for Type A heavy rip-rap shall be sound, durable, igneous or metamorphic rock obtained from approved sources, and shall be free from seams, cracks, and other imperfections tending to destroy its resistance to weathering and the action of sea water. The stones shall be free from rounded, worn, or weathered surfaces and shall have a unit weight of at least 166 pounds per cubic foot.

Type B Heavy Rip-Rap. (51,000 tons). Type B heavy rip-rap shall be composed of angular stones weighing not less than 2 tons each and not more than 4 tons each, averaging 3 tons each. Neither the width nor thickness of any piece of heavy rip-rap shall be less than one-third its length.

The quality of the stones for heavy rip-rap shall comply with the requirements above speci-

Figure 12 — Gravel being unloaded at the Cape Charles Plant of the Bayshore Concrete Products Corporation

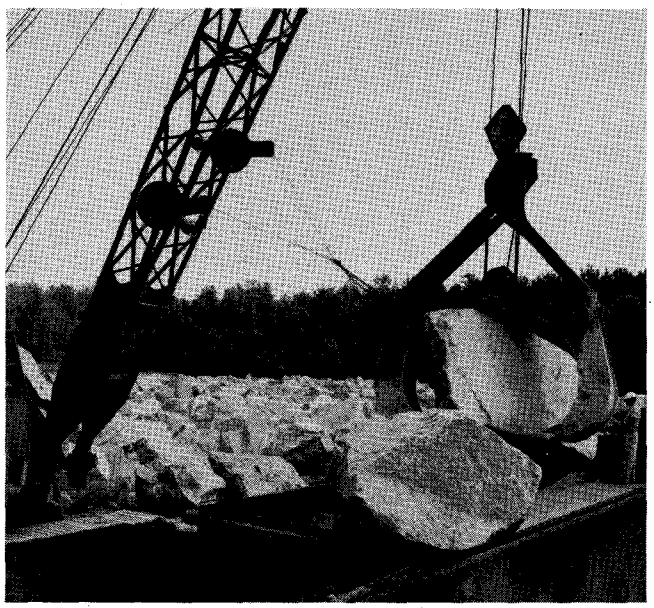


Figure 13 — A large rip-rap block being lifted by the use of a grapple hook

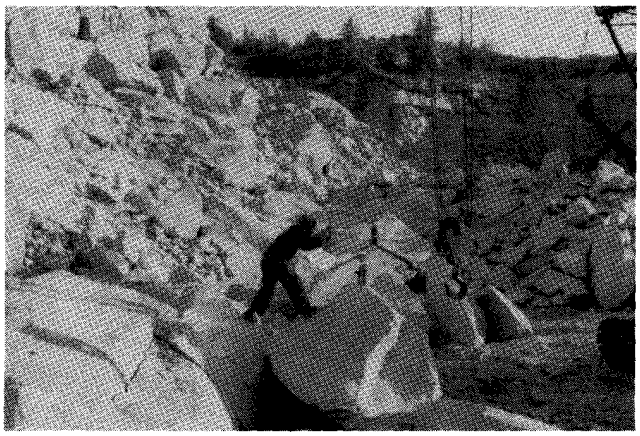


Figure 14 — A large rip-rap block being lifted by the use of an expansion pin

fied for stones for quarry run rock.

Typical uses of the different sizes of rock materials are illustrated in Figures 7 and 10.

Testing Laboratory Assures Quality Control

In order to insure that a high quality stone is obtained, daily checks on specific gravity and absorption are made. Tests for organic impurities are made on sand and gravel utilized in precast and prestressed concrete. All of these tests are conducted in a laboratory at Cape Charles operated by Sverdrup & Parcel-Consulting Engineers.

A daily check of sand and gravel plants near Richmond and a monthly check of each quarry furnishing stone is made by Froehling and Robertson Company, Richmond.

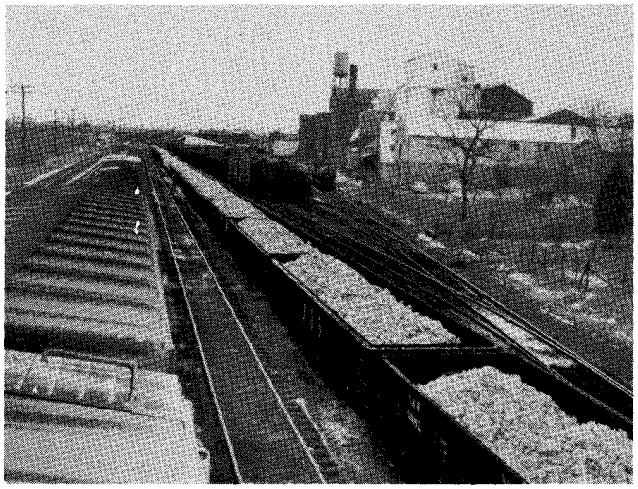


Figure 16 — Crushed rock en route to Sewells Point, Norfolk

Figure 15 — The "Jack Quarry" of Southern Materials Company near Petersburg

Acknowledgments

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Acknowledgment is due Mr. Wesley Wright, Secretary, Southern Materials Company for his time and assistance. The aid and courtesies extended by Mr. W. K. Norman are also appreciated. Many photographs used were provided by the Southern Materials Company and by the Chesapeake Bay Bridge and Tunnel Commission.

Special thanks are due each of the aggregate producers for assistance in furnishing information.

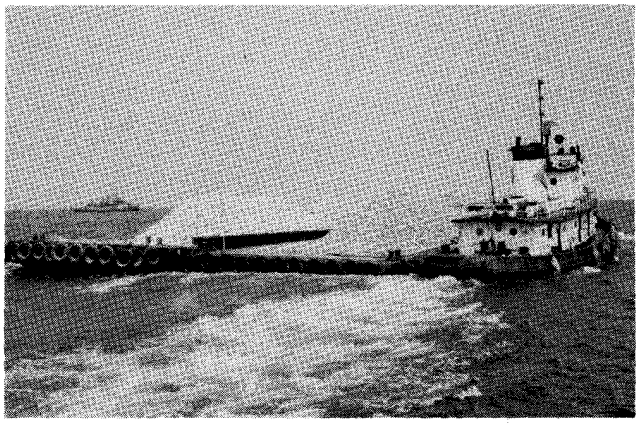

Figure 17 — Barge with approximately 800 tons of stone on board being towed into Chesapeake Bay

NEW PUBLICATION

Min. Res. Rept. 2. ANALYSES OF CLAY, SHALE AND RELATED MATERIALS — NORTHERN COUNTIES by James L. Calver, Howard P. Hamlin and Robert S. Wood. 194 p. Price: $1.00

Descriptions of tests used in the evaluation of clay materials for possible commercial utilization are discussed. The report contains tests and determinations of properties required to evaluate the potential ceramic and nonceramic uses of 111 samples of clay, shale, mudstone, slate, phyllite, and schist. The localities sampled are in the following counties in Virginia: Clarke, Culpeper, Fairfax, Fauquier, Frederick, Greene, Loudoun, Madison, Orange, Page, Prince William, Rappahannock, Rockingham, Shenandoah, Spotsylvania, Stafford, and Warren.

TWO GEOLOGY TEXTS

"Basic Concepts of Historical Geology" by Edgar Winston Spencer, a new textbook, will be available from the Thomas Y. Crowell Company in January, 1962. This work, one volume of a two volume set, is well illustrated with photographs and line drawings. Professor Spencer presents a history of the earth from its beginning and guides the reader through approximately four-billion years of the history of the earth, its rocks, and its structure to development of plants and animals. A companion volume, "Basic Concepts of Physical Geology," also will be available in January. In writing these texts Professor Spencer, Chairman, Department of Geology, Washington and Lee University, has assumed that the student comes to his first course in geology without a background in natural science, and has a curiosity about the earth on which he lives. Interesting reading for those who wish to know more about their natural surroundings, as well as for students, is contained in this text where scientific terminology is held to a minimum and defined where used.

AGE OF BIOTITE FROM THE COLUMBIA GRANITE

A sample of biotite gneiss was collected from the Cowherd quarries on the outskirts of Columbia, Fluvanna County, Virginia, the type locality of the Columbia granite. The rock is gray, medium-grained, even-granular, and contains biotite in thin parallel streaks. The major constituents are quartz, plagioclase feldspar, potash feldspar, and biotite. The Geochron Laboratories, Inc. of Cambridge, Massachusetts determined the age of the biotite by the potassium-argon method, to be 301 ± 15 million years (Carboniferous period.) The biotite probably grew during the last metamorphism and associated deformation that occurred in the area.

NEW DEVELOPMENTS

Coggins Granite Industries, Incorporated of Elberton, Georgia, is currently removing test blocks of stone at a dimension-stone quarry site about one mile east of Buena, Culpeper County. The company will operate as the Virginia Granite Corporation and has plans to market monumental and structural stone. Mr. Robert Lee Aston will be in charge of the Buena Quarry.

The Buena Quarry is on Buzzard Mountain in rock mapped as diabase of Triassic age. Diabase was formerly quarried in the area for use as railroad ballast and dimension stone and is currently quarried at other locations in Northern Virginia for use as crushed stone.

* * * * * *

The Culpeper Sand Company has transferred operations from Culpeper County to a site in Stafford County near Fredericksburg and is now operating as the Fredericksburg Sand and Gravel Company, Incorporated.

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The Potomac Sand and Gravel Company has acquired the sand and gravel operation of the Brown Construction Company near Colonial Beach and has moved the plant from that location to their Coles Point site, Westmoreland County.

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The Dominion Sand and Gravel Corporation of Stafford began production of sand along Aquia Creek in Stafford County in June, 1961.

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The Harwell Construction Company of Orange is producing and crushing stream gravel near Syria, Madison County.

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The Terra Alta Limestone Company of Aurora, West Virginia, is producing limestone at a quarry site near Gore, Frederick County. The stone is crushed for use in a highway project.

* * * * * *

Colonial Brick of Williamsburg, Incorporated is manufacturing colonial hand-made brick at Five Forks, James City County.

Division of Mineral Resources

Box 3667

Charlottesville, Virginia

Form 3547 Requested

SUMMARY OF OIL AND GAS WELL DRILLING FIRST HALF—1961

Completions

During the first half of 1961, a total of 7 wells were reported completed in 4 counties by 5 operators. Of these wells 4 wells with a combined footage of 21,002′ were completed as natural gas wells having a combined initial potential of 8,475,000 cubic feet per day. Three wells with a combined footage of 12,993′ were dry holes.

By comparison, during the first half of 1960, 2 wells were reported completed, both as natural gas wells, with a total footage of 8947′ and a combined initial potential of 2,581,000 cubic feet per day.

New Wells

During the first half of 1961, 10 new well proposals were recorded, of which 8 are in Buchanan County, 1 in Tazewell County, and 1 in Scott County.

Operator Farm	Well No.	Approximate Location	Total Depth	Completion Date	Result
Buchanan					
Cabot Corporation					
Randal Jewel	1-1514-V	5400′ S. of 37°20′ 9900′ W. of 81°50′	5220′	3-15-61	Gas Well
United Fuel Gas Company					
Zach Justice	8848	11,150′ S. of 37°30′ 12,250′ E. of 82°05′	4815′	1-26-61	Dry hole
National Shawmut Bank of Boston	8916	11,600′ S. of 37°30′ 8600′ W. of 82°00′	4900′	4-13-61	Dry hole
United Producing Company					
Lon B. Rogers	17	10,000′ S. of 37°20′ 9900′ W. of 81°50′	5270′	4-6-61	Gas Well
King William					
Roberts Drilling Company					
Hugh Townsend	1	11,100′ N. of 37°40′ 12,100′ W. of 77°15′	3278′	3-4-61	Dry hole
Tazewell					
United Fuel Gas Company New River & Pocahontas Consolidated Coal Company	9050	14,400′ S. of 37°15′ 15,250′ W. of 81°40′	5145′	6-20-61	Gas Well
Wise					
Clinchfield Coal Company					
Virginia Coal & Iron Company	217	13,500′ S. of 37°00′ 10,250′ W. of 82°45′	5367′	3-31-61	Gas Well